

cold, the Hudson river being locked in by ice for a period of one hundred and twenty-five days. Since 1790, the river was closed ten times during the month of November, as follows:

Year.	Date of closing.	Year.	Date of closing.
1796.....	November 28th	1835.....	November 30th
1797.....	" 26th	1838.....	" 25th
1798.....	" 23d	1842.....	" 29th
1820.....	" 13th	1871.....	" 30th
1827.....	" 25th	1880.....	" 25th

ICE IN RIVERS AND HARBORS.

Penobscot river.—Bangor, Maine: the river froze over at this place on the 29th.

Buffalo river.—Buffalo, New York: the first ice of the season in the river, at this place, appeared on the 16th.

Maumee river.—Toledo, Ohio: the river was covered with a thin film of ice on the 16th.

Grand river.—Grand Haven, Michigan: the first ice of this season in the Grand river formed on the 16th.

Lake Superior.—Marquette, Michigan: the schooner "Reuben Dowd" and all the tugs went into winter quarters on the 30th.

Duluth, Minnesota: Lake Superior was free from ice at this place on the 30th.

Saint Louis and Duluth bays.—Duluth, Minnesota: on the 16th Duluth bay was partly frozen over; boats experienced difficulty in forcing passage. On the 16th the ice on Saint Louis and Duluth bays was sufficiently strong to bear up the weight of persons. On the 17th the ice was reported to be six inches thick. Both the bays were frozen over on the 30th, and teams were crossing on the ice.

Mississippi river.—Dubuque, Iowa: thin ice formed along the shores on the 14th; floating ice on the 15th, 16th, 17th, 29th.

Saint Paul, Minnesota: floating ice 14th, 26th; on the 15th the ice formed a dam in the river; on the 25th the ice-dam moved out, leaving the river clear; another ice-dam formed on the 28th.

Other stations on the Mississippi river report floating ice as follows: Burlington, Iowa, 15th, 16th; Keokuk, Iowa, 16th to 19th; La Crosse, Wisconsin, 14th, 15th; Davenport, Iowa, 14th to 18th; Muscatine, Iowa, 15th.

Milwaukee river.—Milwaukee, Wisconsin: the river froze over at this place on the 16th.

Missouri river.—Fort Sully, Dakota: navigation was interrupted by floating ice on the 14th; river froze over on the 26th.

Yankton, Dakota: the river was blocked with ice on the 17th.

Other stations report floating ice as follows: Fort Bennett, Dakota, 12th, 14th, 15th; Omaha, Nebraska, 14th, 27th; Leavenworth, Kansas, 17th, 18th, 19th.

At Fort Benton, Montana, the river froze over on the 25th.

Red river (of the north).—Saint Vincent, Minnesota: the river froze over at this place on the 11th.

FLOODS.

Saint Louis, Missouri.—A severe rain storm prevailed throughout the state on the 21st, causing great damage to all kinds of property. It was especially severe in the southeastern part of the state. At Fredericktown, Madison county, a creek that runs through the town rose so rapidly as to sweep away several houses. At Piedmont, Wayne county, all but two of the houses in the place were washed away, and several persons were drowned. All of the streams in that vicinity overflowed, causing much damage to crops and farming property. The creeks in Wayne and Reynolds counties were higher than ever before known. The heavy rain storm of this date also extended over the greater part of southern Illinois. The streams in the vicinity of Mount Vernon, Jefferson county, overflowed, greatly damaging the crops in the low-lands. Trains on the Louisville and Nashville Air Line roads were delayed on account of wash-outs. In the vicinity of Duquoin, Perry county, a large area

was overflowed, and many bridges were washed away. Eleven coal mines near Belleville, Saint Clair county, were flooded, throwing about one hundred men out of employment, and causing damage estimated at \$500,000.

Indianapolis, Indiana.—The heavy rains of the 21st and 22d caused great damage in the southern part of this state. In the lower part of Knox county, near the confluence of the Wabash and White rivers, much farming land was overflowed, and heavy losses were sustained by the farmers in that region. Many bridges in the central part of the state were washed away, causing serious interruption to railroad travel. In the southern part of the state a large number of sheep and cattle were drowned, and numerous houses washed away. At noon, of the 23d, the White river, at Indianapolis, was within two feet of the high-water mark of February, 1883. On this date the low grounds in Indianola, on the west side of the river, were covered with water. On the 24th the White river overflowed its banks, flooding residences, elevators, and factories opposite this city.

Vincennes, Knox county, Indiana.—On the morning of the 21st the large dam of the Spring Lake Ice Company, a short distance from this city, broke, sending a volume of water through the town. Many houses were flooded and much damage done.

Bedford, Lawrence county, Indiana, 23d.—The recent very heavy rains caused great damage in the northern part of this county, and also in Monroe county, lying northward. The greatest damage was done about twelve miles north of Bedford, where about one mile of the Louisville, New Albany and Chicago railroad track was washed from the road-bed, and about ten miles of the road were badly damaged. Very heavy losses in stock, ungathered corn, and other property, were sustained.

Terre Haute, Indiana, 23d.—Portions of this city were submerged by the recent heavy rains. Wash-outs occurred on nearly all the railroads centring here, causing suspension of travel. The most serious damage was that caused by the overflow of the Wabash river, and the consequent submerging of thousands of acres of corn land.

HIGH TIDES.

Eastport, Maine, 15th.—The highest tides observed for several years occurred on this date. The tides were also very high on the 16th.

Block Island, Rhode Island.—Very high tides were caused by the high easterly wind on the 26th. At 7 p. m. the tide ran into Harbor pond, two hundred feet from the mean high-tide mark.

Hatteras, North Carolina.—Very high tide in the sound on the 27th.

Sloop Point, North Carolina.—High tides 30th.

LOW TIDES.

Block Island, Rhode Island.—Low tides occurred here on the 12th, 13th, and 26th. On the 13th the tide was lower than has been observed since the establishment of the United States Coast Survey tide-gauge at this place.

Low tides were also reported from New Haven, Connecticut, and Narragansett Pier, Rhode Island, on the 12th, and at Cedar Keys, Florida, on the 17th.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for November, 1883, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 86.22 per cent. The percentages for the four elements are: weather, 88.31; direction of the wind, 81.54; temperature, 88.04; barometer, 86.92 per cent. By geographical districts they are: For New England, 81.17; middle Atlantic states, 89.96; south Atlantic states, 88.00; eastern Gulf,

88.22; western Gulf, 87.72; lower lakes, 87.22; upper lakes, 86.30; Ohio valley and Tennessee, 89.69; upper Mississippi valley, 82.44; Missouri valley, 72.80; north Pacific, 92.00; middle Pacific, 81.03; south Pacific, 96.30.

There were one hundred and thirty-seven omissions to predict out of 3,690, or 3.71 per cent. Of the 3,553 predictions that have been made, one hundred and eighteen, or 3.32 per cent., are considered to have entirely failed; one hundred and thirteen, or 3.18 per cent., were one-fourth verified; four hundred and thirty-five, or 12.24 per cent. were one-half verified; two hundred and seventy-seven, or 7.80 per cent., were three-fourths verified; 2,610, or 73.46 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During November, 1883, two hundred and forty-one cautionary signals were displayed. Of these, two hundred and three, or 84.2 per cent., were justified by winds of twenty-five miles, or more, per hour, at or within one hundred miles of the station. Fifty-two cautionary off-shore signals were displayed, all of which were justified as to velocity, and fifty or 96.2 were justified both as to direction and velocity. There were no "north-west" signals ordered on the lakes during the month. Two hundred and ninety-three signals of all kinds were displayed, of which two hundred and fifty-three, or 86.4 per cent., were fully justified. These do not include signals ordered at display stations where the velocity is only estimated. Twenty-one signals were ordered late.

Forty winds of twenty-five miles, or more, per hour were reported, for which no signals were ordered.

TEMPERATURE OF WATER.

Temperature of Water for November, 1883.

STATION.	Temperature at bottom.		Range.	Average depth, feet and inches.		Mean temperature of the air at station.
	Max.	Min.				
Atlantic City, New Jersey.....	55.6	41.6	14.0	ft. in.		45.9
Alpena, Michigan.....	47.6	31.0	10.6	11 10		33.6
Augusta, Georgia.....	67.5	53.0	14.5	5 8		57.4
Baltimore, Maryland.....	57.0	45.0	12.0	9 0		48.2
Block Island, Rhode Island.....	53.1	43.2	9.9	8 5		46.0
Boston, Massachusetts.....	49.6	40.0	9.6	22 2		42.5
Buffalo, New York.....	49.6	35.0	14.6	10 2		43.5
Cedar Keys, Florida.....	79.9	55.9	24.0	11 8		65.8
Charleston, South Carolina.....	68.3	55.9	12.4	41 6		59.4
Chicago, Illinois.....	48.3	34.3	14.0	8 1		47.5
Chincoteague, Virginia.....	60.0	43.2	16.8	5 5		49.1
Cleveland, Ohio.....	50.0	37.6	12.4	14 0		43.0
Detroit, Michigan.....	47.0	30.0	17.0	21 11		43.8
Delaware Breakwater, Delaware.....	56.0	45.3	10.7	8 10		48.3
Duluth, Minnesota.....	45.7	35.3	10.4	15 7		29.7
Eastport, Maine.....	47.7	44.2	3.5	15 11		36.8
Escanaba, Michigan.....	45.8	34.5	11.3	15 4		32.6
Fort Macon, North Carolina.....	66.5	51.0	15.5	3 7		55.6
Galveston, Texas.....	74.0	52.3	21.7	11 0		60.0
Grand Haven, Michigan.....	46.8	32.3	14.5	19 0		40.8
Indianola, Texas.....	77.1	53.8	23.3	8 6		66.3
Jacksonville, Florida.....	74.8	62.0	12.8	18 0		63.3
Key West, Florida.....	80.4	73.0	7.4	17 7		75.0
Mackinaw City, Michigan.....	47.6	31.8	15.8	10 0		35.6
Marquette, Michigan.....	42.7	35.0	7.7	9 10		32.4
Milwaukee, Wisconsin.....	46.5	34.0	12.5	8 0		38.3
Mobile, Alabama.....	71.0	58.0	13.0	14 9		60.5
New Haven, Connecticut.....	50.9	39.5	11.4	13 9		42.1
New London, Connecticut.....						
New York City.....	53.5	44.7	8.8	16 4		45.0
Norfolk, Virginia.....	60.5	50.0	10.5	17 3		53.7
Pensacola, Florida.....	71.2	56.7	14.5	16 8		61.5
Portland, Maine.....	47.0	41.5	5.5	10 6		42.0
Portland, Oregon.....	49.6	45.5	4.1	55 11		46.5
Provincetown, Massachusetts.....	51.0	43.1	7.9	12 8		43.7
Sandusky, Ohio.....	48.5	32.5	16.0	9 9		44.1
Sandy Hook, New Jersey.....	56.0	43.5	12.5	1 0		46.0
San Francisco, California.....	57.2	52.2	5.0	39 9		53.5
Savannah, Georgia.....	66.7	57.3	9.4	11 9		59.6
Smithville, North Carolina.....	66.4	53.2	13.2	10 0		55.8
Toledo, Ohio.....	48.2	32.4	15.8	11 0		44.2
Wilmington, North Carolina.....	63.0	51.0	12.0	21 8		57.0

* No observations from 1st to 8th, inclusive.

The temperature of water, as observed in rivers and harbors at the Signal Service stations, during November, 1883, with the average depth at which the observations were made, are given in the table below. The highest water temperature observed

during November, 80° 4, occurred at Key West, Florida, on the 1st; the lowest, 31°, occurred at Alpena, Michigan, on the 30th. The largest monthly ranges are: Galveston, Texas, 21° 7; Indianola, Texas, 23° 3; Cedar Keys, Florida, 24°. The smallest monthly ranges are: Eastport, Maine, 3° 5; Portland, Oregon, 4° 1; San Francisco, California, 5°; Portland, Maine, 5° 5.

ATMOSPHERIC ELECTRICITY.

AURORAS.

On the night of the 1st an auroral display was observed from Minnesota eastward to New England, and on the following night a display was observed throughout the northern portions of the United States. The latter display was observed as far southward, on the Atlantic coast, as Portsmouth and Fort Macon, North Carolina; over the central portions of the country it was not reported by stations farther southward than central Illinois; and west of the ninety-second meridian it was observed only at the more northerly stations.

The following reports, relating to the several displays of the month, have been received:

Eastport, Maine, 1st.—A faint auroral light was observed from 8 to 11 p. m.

Portland, Maine, 1st.—A faint aurora was observed from 8.30 to 9.25 p. m.

Boston, Massachusetts, 1st.—An auroral light of bluish-green color, extending over about 20° of the northern sky, was observed from 2.30 a. m. until daylight.

New Haven, Connecticut, 1st.—A dim auroral light was seen in the northern sky at 11 p. m.

Barnegat City, New Jersey, 1st.—A brilliant aurora was observed from 8.35 to 10.05 p. m. When first seen it consisted of a diffuse light of pale yellow color; at 9 p. m. luminous beams rose to an altitude of 25°, gradually fading and reappearing. The whole display was of varying brilliancy, the color at times being very bright.

Escanaba, Michigan, 1st.—A diffuse auroral light appeared at 7 p. m., and continued until 10 p. m., when the whole sky became covered with clouds, and a narrow band of yellowish light extended almost entirely around the horizon at an altitude of 4°, the band varying in width from one to one and one-half degrees.

Duluth, Minnesota, 1st.—From 8.30 to 9.45 p. m. a faint auroral light, with occasional streamers, was observed.

Dubuque, Iowa, 1st.—A bright white auroral light, over a bank of cloud, was observed in the northern sky from 7.10 to 11.30 p. m.

Other stations reporting the display of the 1st, are: Southington, Connecticut; Logansport, Indiana; Moorestown, New Jersey; Northfield, Minnesota.

Eastport, Maine, 2d.—An auroral arch was visible from 9 p. m. until the early morning of the 3d.

Point Judith, Rhode Island, 2d.—At 6 p. m. a faint auroral light appeared in the northern sky; at 8 p. m. a low arch formed, extending from northwest to northeast; at 8.15 p. m. beams of bright yellow color shot upward to an altitude of 30°. The display ended during the early morning of the 3d.

Captain H. R. Hughes, of the s. s. "Alene," reports having observed a brilliant aurora when off Barnegat, on the 2d.

Atlantic City, New Jersey, 2d.—At 6.30 p. m. an auroral arch extended over about 50° of the northern horizon; a few minutes later a band of light, 4° in width, rose from the top of the arch to an altitude of 40°. The display ended at 10.30 p. m.

Portsmouth, North Carolina, 2d.—A faint aurora was seen here from 8.20 to 9.15 p. m., consisting of a dull straw-colored arch.

Oswego, New York, 2d.—An auroral display began at 8 p. m. and was obscured by clouds at 10 p. m. It consisted of beams of light, of various colors, reaching a height of 45°.

Cleveland, Ohio, 2d.—A steady auroral light and an imperfect arch were visible from 7 p. m. until the morning of the 3d.